

REMARKS

The Office Action mailed October 4, 2005, has been received and reviewed. Claims 1 through 6 and 9 through 15 are currently pending in the application. Claims 1 through 6 and 9 through 15 stand rejected. No claims are amended herein. Reconsideration is respectfully requested.

Power of Attorney

Applicant notes that a Revocation of Power of Attorney, New Power of Attorney and Change of Correspondence Address was submitted to the Patent and Trademark Office on March 28, 2005. (A copy of the documents with the corresponding return postcard is enclosed herewith). While Joseph A. Walkowski of TraskBritt is indicated on the PAIR site as an attorney of record, the correspondence address is incorrect and applicant's prior attorneys are still listed. Applicant respectfully requests that the change in Power of Attorney and correspondence address be entered.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,847,461 to Xu et al. in view of U.S. Patent No. 6,217,721 to Xu et al. and U.S. Patent No. 5,869,395 to Yim

Claims 1 through 6 and 9 through 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Xu et al. (U.S. Patent No. 5,847,461) in view of Xu et al. (U.S. Patent No. 6,217,721) and Yim (U.S. Patent No. 5,869,395). Applicant respectfully traverses this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir.

1991). (Emphasis added).

Xu '461 teaches an integrated circuit structure having an insulating layer 10 formed over integrated circuit structure 2. Openings 14 and 16 are formed in insulating layer 10 and extend downwardly from upper surface 12 of the insulating layer 10 to expose surfaces 4 and 6 of integrated circuit structure 2 at the bottom of the openings 14 and 16. A barrier layer 20 is formed over upper surface 12 and insulating layer 10 as well as over the side walls of openings 14 and 16 and over exposed surfaces 4 and 6 at the respective bottoms of openings 14 and 16 (Xu '461, col. 3, lines 12-22). A metal layer 30 comprising a layer of compressively stressed metal is subsequently extruded down into openings 14 and 16 (*Id.*, co. 4, lines 17-23). A cap layer 40 is formed over is formed over metal layer 30. The cap layer 40 of compressively stressed metal is formed over metal layer 30. The cap layer 40 comprises a high tensile strength material to restrain the upward movement of metal layer 30 during the subsequent extrusion step. (*Id.*, col. 6, lines 26-34). Xu '461 teaches that seed layers are undesirable when filling small openings and is directed toward other methods of filling the contact openings. (*Id.*, col. 1, line 56 – col. 2, line 27). While Xu '461 focuses on the limitations of tungsten as a seed layer, its teaching that that seed layers add “further deposition and planarization steps, resulting in more cost, and less reliability” would apply to seed layers generally. (*Id.*, col. 2, lines 7-9). Thus, Xu '461 proposes a method to “fill very small diameter openings in an insulating layer with metal such [as] aluminum **initially deposited on the surface of the insulating layer.**” (*Id.*, col. 2, lines 19-22, emphasis added).

Yim discloses a method of creating interconnects, but fails to teach or suggest using a seed layer.

Xu '721 teaches a method of filling contact holes 140. A PVD process is used to coat a liner layer 152 onto the sides of a contact hole 140. The liner layer 152 may include a first sublayer 160 of titanium silicide, a second sublayer of titanium nitride 162 and a third sublayer of titanium 164 (deposited as titanium nitride). (Xu '721, col. 12, line 50 – col. 13, line 6; FIG. 8). Standard PVD then deposits a metal layer 156 over the third sublayer 164. The two Xu references teach alternative methods of filling a contact structure and no motivation exists to combine portions of the first method (i.e., Xu '461) with a second distinct method (i.e., Xu '721).

Applicant respectfully submits that the proposed combination of references fail to teach or suggest “applying energy to the energy absorbing layer sufficient to cause the electrically conductive layer to flow within the recess” as recited in claim 1 of the presently claimed invention. Instead, Xu ‘461 teaches that the structure should be heated “to a minimum temperature at which plastic deformation of metal layer 30 will occur, but lower than the melting temperature of metal layer 30.” (Xu ‘461, col. 7, lines 1-7). Xu ‘761 and Yim lack any similar teaching or suggestion.

Further, the aluminum layer 30 in Xu ‘461 does **not** extend within the recess. (Xu ‘461, col. 4, lines 24-27). The recess is filled by heating the aluminum layer 30 and allowing the aluminum layer 30 to extrude into the recess, but not become molten. (*Id.*, col. 7, lines 1-8). Xu ‘721 discloses completely filling the via by a PVD process. Thus, assuming the liner layers 152 of Xu ‘721 could be incorporated into the structure of Xu ‘461, which applicants do not concede, no reason would exist to fill the via by applying heat and extruding the metal as disclosed in Xu ‘461.


As the proposed combination of references fail to teach or suggest every element of independent claim 1 of the presently claimed invention, the proposed combination of references cannot render independent claim 1 of the presently claimed invention obvious. Thus, claim 1 is allowable.

Claims 2- 6 and 9 – 15 are each allowable as depending, either directly or indirectly, from allowable claim 1.

CONCLUSION

Claims 1-6 and 9-15 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicant's undersigned attorney.

Respectfully submitted,



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Date: January 3, 2006
KWP:djp:lmh
Document in ProLaw

THE PATENT & TRADEMARK OFFICE MAILROOM DATE
STAMP HEREON IS AN ACKNOWLEDGEMENT THAT IN THIS
DATE THE PATENT & TRADEMARK OFFICE RECEIVED

Request for Continued Examination Transmittal (1 page); Check No. 7588
for the amount of \$790; Amendment Accompanying RCE (8 pages); and
Power of Attorney, Revocation of Prior Power of Attorney And Request to
Change Correspondence Address With Statement Pursuant to 37 CFR 3.72

Invention: UTILIZATION OF ENERGY ABSORBING LAYER
TO IMPROVE METAL FLOW AND FILL IN A
NOVEL INTERCONNECT STRUCTURE

Applicant(s): Givens

Filing Date: February 14, 1997

Serial No.: 08/801,812

Date Sent: March 28, 2005 via Express Mail Label No.

EL 994843784 US

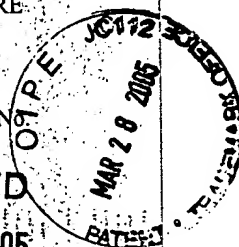
Docket No.: 2269-6888US

JAW/nj:sm

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TRASKBRITT PC



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**REQUEST
FOR
CONTINUED EXAMINATION (RCE)
TRANSMITTAL**

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	08/801,812
Filing Date	February 14, 1997
First Named Inventor	Givens
Art Unit	2823
Examiner Name	J. Maldonado
Attorney Docket Number	2269-6888US (95-1078.00/US)

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application. Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. **Submission required under 37 C.F.R. 1.114**

- a. ☐ Previously submitted
- i. ☐ Consider the amendment(s)/reply under 37 C.F.R. 1.116 previously filed on _____
(Any unentered amendment(s) referred to above will be entered).
- ii. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- iii. ☐ Other _____
- b. Enclosed
- i. ☒ Amendment/Reply
- ii. ☐ Affidavit(s)/Declaration(s)
- iii. ☐ Information Disclosure Statement (IDS)
- iv. ☐ Other _____

2. **Miscellaneous**

- a. ☐ Suspension of action on the above-identified application is requested under 37 C.F.R. 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 C.F.R. 1.17(i) required)
- b. ☐ Other _____

3. **Fees** The RCE fee under 37 C.F.R. 1.17(e) is required by 37 C.F.R. 1.114 when the RCE is filed.

- a. ☒ The Director is hereby authorized to charge any deficiency in the following fees, or credit any overpayments, to Deposit Account No. 20-1469
- i. ☒ RCE fee required under 37 C.F.R. 1.17(e)
- ii. ☐ Extension of time fee (37 C.F.R. 1.138 and 1.17)
- iii. ☐ Other _____
- b. ☒ Check in the amount of \$790 enclosed
- c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Name (Print /Type)	Joseph A. Walkowski	Registration No. (Attorney/Agent)	28,765
Signature		Date	March 25, 2005

CERTIFICATE OF MAILING

Express Mail Label Number: EL 994843784 US

Date of Deposit: March 28, 2005

Person Making Deposit: Steve Wong

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND Fees and Completed Forms to the following address: Mail Stop RCE, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Givens

Serial No.: 08/801,812

Filed: February 14, 1997

**For: UTILIZATION OF ENERGY
ABSORBING LAYER TO IMPROVE
METAL FLOW AND FILL IN A NOVEL
INTERCONNECT STRUCTURE**

Confirmation No.: 6774

Examiner: J. Maldonado

Group Art Unit: 2823

**Attorney Docket No.: 2269-6888US
95/1078.00/US**

NOTICE OF EXPRESS MAILING

Express Mail Mailing Label Number: EL 994843784 US

Date of Deposit with USPS: March 28, 2005

Person making Deposit: Steve Wong

**AMENDMENT ACCOMPANYING
REQUEST FOR CONTINUED EXAMINATION**

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

**PLEASE NOTE ENCLOSED POWER OF ATTORNEY, REVOCATION OF
PRIOR POWER OF ATTORNEY AND REQUEST TO CHANGE CORRESPONDENCE
ADDRESS WITH STATEMENT PURSUANT TO 37 CFR 3.73.**

The following amendments and remarks are filed with a Request for Continued Examination (RCE).

Serial No. 08/801,812

Please amend the above-referenced application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

IN THE CLAIMS:

Please cancel claims 16 through 63 without prejudice or disclaimer to pursuit of the subject matter thereof in a continuing application.

Claims 1 through 15 have been amended herein. Please note that all claims currently pending and under consideration in the referenced application are shown below. Please enter these claims as amended. This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Currently amended) A method for manufacturing an interconnect structure comprising consisting essentially of:

forming a recess within a dielectric material situated on a semiconductor ~~lower~~ substrate, ~~said the~~ recess extending below a top surface of ~~said the~~ dielectric material;

forming a diffusion barrier layer substantially conformally on the top surface of the dielectric material and over an interior surface of the recess ~~within the dielectric material;~~

forming a seed layer on the diffusion barrier layer over the top surface of the dielectric material and within the recess, the diffusion barrier layer ~~being composed of~~ comprising a material having a melting point greater than or equal to that of a material ~~from which comprising the seed layer is composed;~~

forming an electrically conductive layer on the seed layer ~~including the portion of the seed layer~~ over the top surface of the dielectric material and within said the recess, the material ~~from which comprising the diffusion barrier layer is composed~~ having a melting point greater than that of a material ~~from which comprising the electrically conductive layer is composed~~, the material ~~from which comprising the seed layer is composed~~ having a melting point greater than or equal to that of the material ~~from which comprising the electrically conductive layer is composed;~~

forming an energy absorbing layer on ~~said~~ the electrically conductive layer, ~~said~~ the energy absorbing layer having a greater thermal absorption capacity than that of ~~said~~ the electrically conductive layer;

applying, omnidirectionally, energy to ~~said~~ the energy absorbing layer sufficient to cause ~~said~~ the electrically conductive layer to flow within ~~said~~ the recess; and

removing portions of the energy absorbing layer and the electrically conductive layer that are situated above the top surface of the dielectric material.

2. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein forming a diffusion barrier layer on the recess within the dielectric material ~~is a~~ is effected by CVD-deposition step.

3. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein the material ~~from which~~ comprising the diffusion barrier layer is ~~composed~~ is selected from the group consisting of ceramics, metallics, and intermetallics.

4. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein the material ~~from which~~ comprising the diffusion barrier layer is ~~composed~~ is selected from the group consisting of aluminum nitride, tungsten nitride, titanium nitride, and tantalum nitride.

5. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, further comprising, prior to forming a seed layer on the diffusion barrier layer, heating the diffusion barrier layer ~~is an~~ in an environment substantially containing a nitrogen gas.

6. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein depositing a seed layer on the diffusion barrier layer ~~is a~~ is effected by CVD-deposition step.

7. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein the material ~~from which~~ comprising the seed layer ~~is composed~~ is selected from the group consisting of ceramics, metallics, and intermetallics.
8. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein the material ~~from which~~ comprising the seed layer ~~is composed~~ is selected from the group consisting of aluminum, titanium nitride, titanium, and titanium aluminide.
9. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein the material ~~from which~~ comprising the electrically conductive layer ~~is composed~~ is selected from the group consisting of aluminum and copper.
10. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein the energy absorbing layer ~~is composed of~~ comprises a material selected from the group consisting of titanium, titanium nitride, tungsten, tungsten nitride, silicon nitride, silicon dioxide, tantalum, tantalum nitride, and carbon.
11. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein applying energy to ~~said~~ the energy absorbing layer utilizes a furnace.
12. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein removing portions of the energy absorbing layer and the electrically conductive layer ~~is an~~ comprises abrasive planarization ~~step~~.
13. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 12, wherein removing portions of the energy absorbing layer and the electrically conductive layer ~~is a~~ comprises chemical mechanical ~~planarizing step~~ planarization.

14. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, ~~wherein~~ further comprising forming the recess ~~has to have~~ an aspect ratio greater than about four (4) to one (1).

15. (Currently amended) A method for manufacturing an interconnect structure as recited in Claim 1, ~~wherein~~ further comprising forming the recess ~~comprises to comprise~~ a contact hole situated below a trench, ~~said semiconductor substrate assembly having a lower substrate defining a plane, said~~ the contact hole terminating at an end thereof at ~~said lower~~ the semiconductor substrate and terminating at an opposite end thereof at ~~said~~ the trench, ~~said~~ the trench extending from ~~said~~ the opposite end of ~~said~~ the contact hole ~~to a~~ to the top surface of ~~said~~ the dielectric material, the trench extending parallel to the plane of the ~~lower semiconductor~~ substrate.

Claims 16 through 63 (Canceled).

REMARKS/ARGUMENTS

Claims 16-63 have been canceled without prejudice or disclaimer. Claims 1 through 15 have been amended herein. Applicants respectfully submit that the claims as presently amended herein are allowable over the references employed by the Examiner during the appeal and as applied by the Board of Patent Appeals and Interferences. No new matter has been entered.

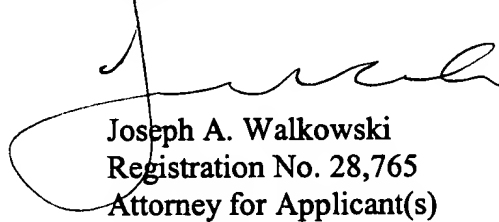
ENTRY OF AMENDMENTS

The amendments to claims 1 through 15 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application.

CONCLUSION

Claims 1 through 15 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,



Joseph A. Walkowski
Registration No. 28,765
Attorney for Applicant(s)
TRASKBRITT
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Salt Lake City, Utah 84110-2550
Telephone: 801-532-1922

Date: March 28, 2005
JAW/nj:sm:cs
Document in ProLaw

**PATENT****IN THE UNITED STATES PATENT AND TRADEMARK OFFICE****In re Application of:****Givens****Serial No.: 08/801,812****Filed: February 14, 1997****For: UTILIZATION OF ENERGY
ABSORBING LAYER TO IMPROVE
METAL FLOW AND FILL IN A NOVEL
INTERCONNECT STRUCTURE****Confirmation No.: 6774****Examiner: J. Maldonado****Group Art Unit: 2823****Attorney Docket No.: 2269-6888US
95-1078.00/US****NOTICE OF EXPRESS MAILING**Express Mail Mailing Label Number: EL 994843784 USDate of Deposit with USPS: March 28, 2005Person making Deposit: Steve Wong**POWER OF ATTORNEY (37 C.F.R. 1.34(a)), REVOCATION OF PRIOR
POWER OF ATTORNEY (37 C.F.R. 1.36) and REQUEST TO
CHANGE CORRESPONDENCE ADDRESS (37 C.F.R. 1.33(d))
with STATEMENT PURSUANT TO 37 C.F.R. 3.73**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

As assignee of the entire interest in the above-identified application, all powers of attorney previously given herein are HEREBY REVOKED and the Registered Practitioners associated with Customer No. 24247 are hereby appointed to prosecute and transact all business in the U.S. Patent and Trademark Office in connection herewith, and with all continuing and divisional applications hereof.

Serial No. 08/801,812

In accordance with 37 C.F.R. 1.33(d), please change the address for all purposes in connection with the above-identified patent application to the address associated with Customer No. 24247, and direct all communications to

JOSEPH A. WALKOWSKI
TRASKBRITT
P. O. Box 2550
Salt Lake City, Utah 84110
(801) 532-1922

Pursuant to 37 C.F.R. 3.73, the undersigned representative of the Assignee has reviewed the evidentiary documents, specifically:

1. The Assignment from John H. Givens to Micron Technology, Inc., recorded on February 14., 1997, at Reel 8481, Frame 0357.

The undersigned further avers that he is empowered to make and sign the foregoing certification on behalf of the Assignee, and to take the action set forth herein on behalf of the Assignee, pursuant to a resolution of its Board of Directors.

Respectfully submitted,

MICRON TECHNOLOGY, INC.

Dated: 3-28-01

By: 
Michael L. Lynch, Esq., Chief Patent Counsel